ARIZONA DEPARTMENT OF WATER RESOURCES
3550 North Central Avenue
Phoenix, Arizona 85012

Phoenix Active Management Area
Water Management Assistance Program
Summary of Funded Projects
1992 – 2007

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The Water Management Assistance Program provides resources to:

- *help augment and reuse water,*
- *provide conservation assistance to water users, and*
- *monitor and assess water availability within the Active Management Area.*

Phoenix AMA Water Management Assistance Program
FOCUS AREAS AND EXAMPLES OF PROJECTS
1992 – 2007

Agriculture Irrigation Efficiency and Crop Water Use

Water Conservation Management Program (1992 – ongoing) $1.5 m
The Water Conservation Management Program (WCMP), administered by the Buckeye Valley Natural Resources Conservation District (NRCD), provides services to help farmers and urban irrigation users in the east and west valley improve the efficiency of their irrigation programs. The 2005 agreement includes assistance to agriculture BMP enrollees, field testing and evaluation by the USDA Natural Resources Conservation Service, and outreach by the UA Cooperative Extension.

Software to Design Sloping Border Irrigation Systems (1994) $45,000
US Water Conservation Laboratory, USDA/ARS (1994) developed a software program to aid in the design of sloping border irrigation systems with tail- water runoff.

Water Use of Cotton (1995) $117,625
University of Arizona studied the quality, feasibility and consumptive water use of several short season cotton varieties and compared them to long season cotton.

Augmentation, Recharge, and Supply Projects

Avondale

Recharge: Avondale Wetlands Study (1996) $212,000. (with ASU)
A study was conducted on the City's nitrate treatment wetland-recharge demonstration project that was to ultimately utilize 35,000 acre-feet of water annually, including 5,000 acre-feet of CAP water. The wetlands are needed to treat SRP canal water which often exceeds the maximum contaminant level for nitrate.

Wetlands Nursery (1994) $10,000
The City of Avondale's wetlands plant nursery was part of a future wetland treatment and recharge system. The goal was to observe and monitor indigenous growth and treatment characteristics provided by native plants transplanted from the Avondale Wastewater Treatment Plant discharge area, as well as give the grantee the opportunity to raise its own plant material for the wetlands project.

Buckeye

Study to Supply High Quality Water to the Town of Buckeye. (1996) $31,500
A water supply strategy was developed to reduce the Town's dependence on poor quality groundwater and reduce the cost of water to residents. The study was to identify sources which would be renewable, adequate to provide for future growth, of acceptable quality and available at a reasonable price.

Cave Creek

Cave Creek Water Supply (2001) $79,349
A water use and demand analysis of the Carefree/Cave Creek Basin focused on the Cave Creek water supply. It included a resource analysis of the western portion of the Basin, current and future water supplies, and recommendations for Cave Creek, Carefree, and northwest Scottsdale.

Chandler

Recharge: Injection Wells at the Chandler Effluent Treatment and Recharge Facility. (1994, 1995) $50,000, $150,000
This project included a pilot injection well (to recharge 3,100 acre-feet of effluent per year at full-scale) and the construction and monitoring of three injection wells which to inject reverse osmosis treated effluent into the aquifer.

Shallow Groundwater Management Strategies - Feasibility Study. (1998) $75,000
Strategies were developed strategies to manage rising shallow, poor quality groundwater resulting from natural recharge, return flows and artificial recharge. An emphasis was on the reuse of shallow groundwater.

East Valley

East Valley Water Forum Management Plans (2002 – 2007) $282,000
This consortium of water providers developed an area-wide management plan that looked at existing infrastructure and resources, groundwater models, and future scenarios to develop a management plan based on "normal" supplies and recharge. In Phase II (2008 – 2010) the impacts of drought are to be examined.

Gilbert

Recharge into Vadose Zone Injection Wells (1994) $51,500
This ongoing project tested the feasibility of recharging reclaimed wastewater into a vadose zone injection well (VZIW) in the vicinity of the Town's wastewater treatment plant. Once installed, the VZIW performance was to be monitored for a sufficient time to determine its suitability as compared to infiltration spreading basins.

Goodyear

Feasibility of CAP Delivery and Recharge (1995, 1996) $117,689, $22,311
The City studied the feasibility of recharging CAP water in the West Valley, including recharge alternatives and the establishment of a direct CAP delivery system through the Beardsley Canal. The second phase developed a detailed technical and hydrological study for the recharge of 120 acre-feet of CAP water.

Recharge and Reuse of Treated Effluent (1995) $75,330
An infrastructure master plan was developed to utilize and recharge up to 21 million gallons per day of treated effluent produced at the Goodyear Wastewater Treatment Plant.

CAP Groundwater Treatment Facility (1995) $124,800
This study identified design criteria for a treatment plant capable of treating both surface and groundwater in the same facility and determined the feasibility of treating CAP water and high TDS groundwater in a conventional water treatment plant.

Mesa

Queen Creek Wash Recharge Study (1994) $21,000
This grant helped fund the completion of a hydrologic feasibility study for storing water underground at the proposed Queen Creek Wash Underground Storage and Recovery Project. The study concluded that approximately 10,000 acre-feet of water could be recharged based on the size and conditions of the proposed recharge project site.

Phoenix

Cave Creek Water Reclamation Plant - Wetlands and Recharge (1998) $50,000
A system of unlined wetlands and recharge basins was designed in an urban area to further treat and recharge effluent generated at the Cave Creek Water Reclamation Plant. The high quality reclaimed water was to be used for recreation, habitat enhancement and augmentation of critical water resources by allowing recharge.

Tres Rios Constructed Wetlands Study (1994, 1997) $150,000, $40,500
This study tested the capability of constructed wetlands to upgrade the quality of treated sewage effluent from the 91st Avenue Wastewater Treatment Plant to levels that would satisfy expected National Pollutant Discharge Elimination (NPDES) Permit requirements. The second phase partially funded additional studies of the constructed wetlands.

Sun City

CAP Water to Sun City (2002) $48,600
A feasibility study was conducted for the Sun City West Property Owners Residents Association (PORA) to look at transporting and using CAP water for golf course irrigation. The project also included an education program for the community about the use of CAP water and conservation.

Surprise

CAP and Effluent Recharge Study (1994) $105,500 $200,000
Research conducted on the recharge capabilities of two spreading basin sites in the City--an effluent site at the waste water treatment plant and a CAP site at McMicken Dam--demonstrated that recharge at both sites would be hydrologically feasible for a large-scale project. The results enabled the City to begin the design and permitting processes needed for full-scale recharge facilities.

Recharge Basins in Fine Grained Soils (1998)
A pilot study systematically evaluated the various methods of operation and maintenance and the effect those techniques have on the long-term sustainability of infiltration rates in recharge basins with fine grained soils. This study is a follow up to the 1994 project (above).

WESTCAPS/City of Glendale

CAP Water Use (1996) $150,000
The grant assisted in funding a Water Resources Director position to coordinate planning efforts of the West Valley Central Arizona Project Subcontractors' Coalition (WESTCAPS). The director's primary duty was to establish and implement a regional planning process to identify, develop, evaluate and recommend courses of action to facilitate the use of CAP water in the West Valley.

Waddel Dam, Lake Pleasant

Waddel Dam CAP Recharge Study (1994) $30,910.
This study tested the feasibility of recharging the aquifer with CAP water in the Agua Fria River basin downstream of Lake Pleasant, developed a recharge plan, and enhanced riparian wildlife habitat along the river below Lake Pleasant.

Research on Water Quality and Recharge

High Quality Recharge Study (ASU 1994) $56,797

This project studied the release of contaminants in the vadose zone from potentially corrosive source waters during groundwater recharge. The interactions of soil minerals with reverse osmosis-treated water, micro-filtered water, CAP water and specific blends of these waters were compared.

Mobile Water Treatment/Recharge Center (ASU 1994) $88,364

This project studied the development of a cost-effective, portable system for filtering and improving the quality of raw water (such as runoff from the Salt and Verde rivers and CAP water) which could then be used for recharge.

Soil Aquifer Treatment Optimization Study (ASU 1994) $57,659

A methodology was developed for determining the optimal operation of soil aquifer treatment (SAT) systems to maximize infiltration under different constraints.

Iron Induced Aquifer Treatment to Improve Water Quality (ASU 1995) $24,470

This study determined if elemental iron is effective in dechlorinating certain organo-chlorine compounds under laboratory conditions. Organo-chionne compounds are significant groundwater contaminants and the use of elemental iron to degrade these contaminants may offer a more cost-effective method to treat groundwater.

Recharge Mounding Prevention Study (UA 1995) $65,283

This project developed a systematic, general method to improve the operation of percolation recharge systems to avoid groundwater mounding problems. The project proposed to develop a methodology for determining the optimal infiltration application cycles and protective well pumping rates to maximize the overall economically feasible recharge rate.

Well Maintenance Technology for Tertiary Effluent (ASU 1995) $77,558

This project determined if wells could be used to recharge effluent directly into water supply aquifers. The effectiveness of several disinfection schemes to control clogging were investigated, as well as the ability of the aquifer to break down potentially hazardous disinfection by-products.

Monitoring

Predict Subsidence with Radar Interferometry (U. of Texas 2001) $36,842
Radar interferograms were purchased and used to identify and monitor subsidence within the Phoenix and Tucson AMAs and to create predictive models of subsidence.

Conservation Programs

Industry - Businesses - Municipalities - Providers

AZMET Turf and Crop ET Data Collection and Dissemination (UA 1994, 1997, 1998) $10,400, $6 000, $8,710

AZMET (Arizona Meteorological Network) monitoring stations were installed throughout the Phoenix AMA. The stations provide real-time data on water requirements for turf via e-mail, fax and the Internet. The data is particularly useful for large industrial turf customers (primarily golf courses) and is also used to determine lawn watering guidelines for the general public.

Dairy Wastewater Treatment with Constructed Wetlands (UA 1994, 1997) $392,180, $159,138
An experimental wetland facility was constructed to treat wastewater generated by a Valley dairy operation and assess the ability of this technology to produce water suitable for recharge and/or reuse in an environmentally sound manner.

El Mirage Computer Tracking System and Education Program (1993) $20,000
The City's computer system was upgraded to more effectively track the water use of its citizens, and a program was developed to educate employees and citizens about the importance of water conservation.

Mesa Multifamily Exterior-Interior Water Use Efficiency (1995, 1997) $96,100, $186,470
This study looked at two multifamily sites (high and low water use) and identified water demand strategies that could improve their water efficiency. The project included a survey, interior and exterior audits, workshops for participants, recommendations, and cost benefit analyses. Site-specific water management strategies (retrofits, landscape conversion and education) were implemented in Phase 2.

Peoria Retrofit Program (1994) $4,000
The City conducted a water conservation plumbing/retrofit program for 150 public housing units.

Phoenix Neighbors Helping Neighbors Program (Phoenix Revitalization Corporation and Labor's Community Service Agency (1994, 1995, 1996) $45,000, $78,100, $48,541

The goals of this program were to promote and assist residents in achieving water conservation in geographic areas with historic high water consumption, economic hardship and a high level of criminal activity; to provide a catalyst and vehicle for neighborhood self-help; and to provide job training and employment opportunities for local residents, particularly youths at risk for gang involvement.

Residential End Use Study (AMWUA 1996) $70,600
This study measured water use in a residential setting, created a database, and provided a resource to evaluate existing conservation measures. Portable data loggers and sensors were fitted to the water meter at each monitored household. When the data was coupled with survey information, variation in water use for each purpose was determined according to factors such as fixture age, volume and frequency of use, household size, age of home, lot size, landscape type, and socio-economic factors. The regional database was combined with other study sites throughout North America to create a nationwide statistical water use model to predict water use.

Reuse of Industrial Process Water Study (Chandler 1996) $50,000

The City of Chandler studied the cost and type of treatment necessary to recycle industrial process water and assess the feasibility of its use in industrial and commercial cooling towers and on landscaping.

Rinse Smart Water-Efficient Spray Valves (2006 to 2008) $381,000
3,000 spray valves are to be installed in the Phoenix AMA (outside of the services areas of the City of Phoenix and Salt River Project). SBW consultants are responsible for a marketing plan, installation, monitoring, tracking in a database, and quarterly status reports.

Seniors Helping Seniors Program (AZ Dept. of Commerce Energy Office 1992, 1995, 1997) $40,000, $37,500, $44,790
This retrofit program included the free installation of fixtures in senior residences by seniors, energy and water conservation education, and provided social services if necessary.

Surprise Model Ordinances for Water Use Restrictions (1995) $50,000
Model water conservation ordinances and guidelines were developed by the City as it developed its water distribution system and service as a water provider.

Technical Water Conservation Training for Industrial / Commercial (AMWUA 1995, 1995) $6,200, $51,000
These grants funded workshops specifically geared to assist commercial and institutional facility managers with performing water audits of their facilities.

Tempe Industrial and Commercial Retrofit Incentive Program (1995) $100,000
A financial incentive program was developed to encourage industrial and commercial water users to implement water conservation measures by providing a rebate for projects that anticipated a water savings of fifteen percent or more of the total water used.

Xeriscape Design Guides for Homebuilders (1998) $367,000
Customized landscape templates were developed for new communities, along with workshops for residents, demonstration areas, and information about landscape and irrigation design, installation, and maintenance. The project included developing and printing 12,000 "Xeriscape: Landscaping with Style in the Sonoran Desert". (see Demonstration Gardens and Publications)

Conservation Programs: Evaluation

ACC Institutional Constraint Resolution (Megecon 1994) $30,000
This project investigated the nature of the institutional constraints between the Department and the Arizona Corporation Commission and possible solutions. Issues related to water conservation program cost recovery were identified and recommendations for resolution of the issues provided.

Evaluation of Non- Per Capita Conservation Programs (UA 1994) $19,000
This grant assisted municipal water providers in the Phoenix AMA in measuring water savings from existing conservation measures, determining key implementation factors, and evaluating the potential savings of proposed conservation programs.

Evaluation of Water Conservation Measures (ASU Morrison Inst. 1994, 1996) $29,600, $62,000
This grant provided the groundwork for a systematic evaluation of conservation measures

employed by water providers throughout the Phoenix AMA in order to meet the mandates of the 1980 Groundwater Management Act. The project included a literature search and an assessment of residential water conservation efforts within the Phoenix AMA. In the second phase, a quantitative model which could be used by water providers for evaluating the costs and benefits of conservation measures was developed.

Water Conservation Consultation (2004-2005) $8,319

Amy Vickers, nationally known author of "Water Use Conservation" provided consultant services to the Department.

Evaluation of AMA Management Plans (UA WRRC 2007) $30,000

The Water Resources Research Center (Sharon Megdal) worked with NAU (Dr. Zachary Smith) to evaluate effectiveness of the ADWR's five Management Plans in order to assist the Department with the development of the Fourth Management Plan. The AWI's contribution was $48,813

Education and Information: Adults
(includes Xeriscape Demonstration Gardens and Publications)

Water Use it Wisely (City of Mesa 2002 – 2006) $445,890

This was ADWR's contribution to a valley wide media plan for water conservation.

Xeriscape™ Booklet (1993) $25,000

Arizona Municipal Water Users Association (AMWUA) created and distributed a Xeriscape booklet that provided colorful pictures of Xeriscape landscaping options and names of all the plants portrayed.

Maricopa Cooperative Extension Office Demonstration Garden Trail Guide and Signs (1994) $4,500

The Master Gardener Program in conjunction with the Maricopa County Extension Office created signs and a Trail Guide pamphlet for use at a demonstration garden and interpretive trail designed to illustrate efficient water use techniques for the Sonoran Desert. The site is located at the Maricopa County Extension Office.

Boyce Thompson Arboretum Interpretive Signs (1994) $20,000

Interpretive signs were created for a demonstration garden of low-water use plants. Topics include functionality of low-water use plants, water efficient landscapes, water harvesting, salts in water and soils, and designing water efficient gardens.

Superstition Springs Botanical Walk, Mesa (1994) $15,000

The City of Mesa enhanced the Botanical Walk at Superstition Springs Mall by developing a low-water use plant brochure, entry signs, desert region signs, plant identification signs, and a maintenance manual.

Tempe Women's Club Park Xeriscape Demonstration Garden (1994) $20,000

A Xeriscape demonstration garden and interpretive signs were installed in an area that had already been in use as a storm water retention basin.

Desert Botanical Garden Center for Desert Living (1995) $50,945

The Desert Botanical Garden increased public awareness of water conservation measures through its Center for Desert Living, the Garden's principle exhibit on the ornamental use of desert plants, desert horticulture and water and energy conservation strategies.

Guidelines for Landscape Drip Irrigation Systems (UA 1995) $117,969
This booklet was part of a project that investigated the causes of drip system failures in the Phoenix. The booklet contains guidelines and techniques for the design, installation, maintenance and operation of drip irrigation systems. (see Horticulture and Irrigation Research)

ANA Plant of the Month and Promotional Education (1995, 1996, 1997) $50,750, $27,300, $30,000
The Arizona Nursery Association developed an education program for nursery personnel, a plant of the month program, a video available at nurseries in kiosks to assist in the education and promotion of low water use plants to the public, and radio promotion of the project.

Xeriscape: Landscaping with Style in the Arizona Desert (1998) $367,000
The Human Productivity Center and Arizona Municipal Water Users Association collaborated to develop and print Xeriscape booklets primarily for new, single-family home buyers and existing homeowners. The project included demonstration areas and workshops in new planned communities, customized landscape templates, and information about landscape and irrigation design, installation, and maintenance.

Horticulture and Irrigation Research

Minimum Irrigation Requirements for Trees (UA 1993) $57,358
This study identified the minimum irrigation requirements for three tree species common to urban landscapes in the Phoenix AMA, developed irrigation schedules for landscape professionals and homeowners and provided guidelines based on research. Two detailed brochures were produced.

Irrigation Requirements for Ground Covers (Boyce Thompson, 1994) $11,558
This project identified new ground covers with potential use in low and middle elevation landscapes of Arizona and quantified water use requirements for both new and currently used ground covers.

Greywater Reuse and Impacts on Plants (Desert Botanical Garden 1994) $59,025
This study determined the effect of graywater on the growth and performance of selected ornamental desert plant species. The project used graywater generated by the occupants of the Desert House, which is located at the Desert Botanical Garden in Phoenix.

AZMET Turf and Crop ET Data Collection and Dissemination (UA 1994, 1997, 1998) $10,400, $6 000, $8,710
AZMET (Arizona Meteorological Network) monitoring stations were installed throughout the Phoenix AMA. The stations provide real-time data on water requirements for turf via e-Mail, fax and the Internet. The data is used for lawn watering guides for the general public, but is particularly useful for large industrial turf customers (primarily golf courses).

Drip System Failures and Impacts (UA 1995) $117,969
This project investigated the causes of drip system failures in the Phoenix area and determined their horticultural and economic ramifications; developed guidelines and techniques for design,

installation, maintenance and operation for drip irrigation based upon findings from interviews, site inspections, laboratory analysis and literature review; and promoted the guidelines through educational materials such as demonstration models, booklets and workshops.

Turf Edge Effect Study (UA 1998) $67,196
This project used microlysimeters and meteorological monitoring to determine how much turf evapotranspiration (ET) is increased at the interface between turfed and surrounding desert landscapes (the "edge effect") and how this enhancement of ET changes with distance from the turf/desert interface.

Tolerance Levels of Grass Varieties to Long-Term Effluent Use (UA 1998) $22,098
This project determined the tolerance levels of modern bermuda grass and perennial rye grass varieties (35 varieties of each grass) to long-term effluent use. The grasses were grown inside a greenhouse hydroponics system developed by the University using a synthetic effluent which matches that of Phoenix effluent.

Education: Youth

Junior High School Water Conservation Curriculum (AMWUA 1992) $35,000
AMWUA contracted with Lynette, Fleming, PhD. to develop a junior high school water conservation curriculum, "Water in our Desert Community: Activities for Grades 6-9".

Low Flow Plumbing Workshops for Students and Homeowners (1992, 1993) $13,000, 13,000, $4,825
Workshops demonstrating the installation and operation of low-flow plumbing fixtures for junior and senior high school students and homeowners were conducted by Mr. Alfred Eichenger of Alfred's Plumbing.

Natural Resource Conservation Workshops for Arizona Youth (NRC WAY) (1993, 1994, 1995, 1996, 1998) $3,150, $3,975, $4,680, $4,680, $4,125
This project provided tuition scholarships for high school students to attend the the NRC WAY workshops which are held for one week each year. Topics covered in the annual workshop are ecology, geology, hydrology, anthropology and forestry. The Department also supplied volunteer instructors.

Duncan Farms Teacher / Student Education Program and Booklet (1996) $12,000
The project consisted of designing and constructing an educational maze about water conservation, 2,000 water conservation education booklets for teachers and 30,000 water conservation children's activity sheets.

Bear Essential News for Kids (1999 – 2005) ~$25 - 30,000/year
From 1998 to 2005, the WMAP funded a monthly page about water conservation ("HydroSmarts" and "Discover the Waters"). The newspaper is designed for children ages 6 to 13 and is also used by educators. It includes news as well as articles and activities about local and state issues such as health and the environment. 190,000 copies are distributed in Maricopa County each month to educational facilities, libraries, parks, pediatricians' offices, and family-oriented retail centers.

Project Wet: Water Education for Teachers (UA WRRC 2002 – 2007): $55,000, $500,380
Arizona Project Wet provides workshops for teachers, water education materials for schools, and water festivals in the Phoenix AMA and around the State. In 2007, Arizona Project Wet

developed Conserve Water AZ, a 336 page resource specifically about Arizona water sources, management, and conservation.

APW Water Festivals (UA WRRC 2002 – 2007) $5,000 each year
This festival moves around the state and is held every year in the Phoenix AMA.

01: Mesa	02: Scottsdale
03: Surprise	04: Chandler
05: Phoenix	06: Chandler (spring)
06: Avondale (fall)	07: Deer Valley (fall)

Water Maze Educational Displays (UA WRRC 2002) $10,000
Interactive displays were developed for loan to schools, libraries, parks, etc.

Technology Research

Evaporative Cooler Water Use in the City of Phoenix (UA 1992, 1993) $40,000, $20,000

This study determined the average volume of water used by evaporative coolers with and without bleed-off systems; the percentage of the volume of water used by the cooler as a portion of total household water use; and the ability of typical residential water meters to record the true volume of water utilized by coolers.

Outdoor Misting System Efficiency (UA 1995) $18,797

This study investigated water usage and efficiency of outdoor misting systems and disseminated findings to the public.

Rinse Smart Water-Efficient Spray Valves (2007 to 2008) $381,000

3,000 spray valves will be installed in the Phoenix AMA outside of the services areas of the City of Phoenix and Salt River Project. SBW consultants are responsible for a marketing plan, installation, monitoring, tracking in a database, and quarterly status reports

Smart Irrigation Controllers (UA 2004 - 2007) $11,000 (+$20,000 from Tucson AMA)

Three types of "smart" irrigation control devices were evaluated for their water savings benefits in residential settings for two years. Results showed the following decreases in total water use: 25% with the ET based controller, 3.2% with the temperature/humidity sensor, and 4.3% with the soil moisture sensor. Because total water use was monitored, the actual irrigation water reductions may be up to nearly twice as great (since 45% water is used outdoors).